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## **Blattisociid mites of Guilan province of Iran with a checklist for Iranian Blattisociid mites (Mesostigmata: Blattisociidae)**

**Mahboubeh JAVADPOUR, Jalil HAJIZADEH & Reza HOSSEINI**

### **Abstract**

The fauna of family Blattisociidae (Acari: Mesostigmata) was studied in Guilan Province, Northern Iran, during 2015-2017. In this study a total of 16 species belonging to 5 genera from the family Blattisociidae were collected and identified. Three species namely *Blattisocius dentriticus* (BERLESE, 1918); *Lasioseius scapulatus* KENNETT, 1958 and *Orthadenella lawrencei* (EVANS, 1957) are new records for the mites fauna of Guilan Province. *Lasioseuse floridensis* BERLESE, 1916 is new for Iran mites fauna. An identification key to the 16 mite species of family Blattisociidae recorded from Guilan Province, and a tabulated checklist for forty blattisociid mites recorded from Iran are also provided.

Key words: Predatory mites, Guilan, Mesostigmata, Blattisociidae, Iran

### **Zusammenfassung**

Die Fauna der Blattisociidae (Acari: Mesostigmata) wurde in Guilan Province, Nord- Iran, in 2015-2017 mit dem Ergebnis von 16 Arten in 5 Gattungen studiert: *Blattisocius dentriticus* (BERLESE, 1918); *Lasioseius scapulatus* KENNETT, 1958 und *Orthadenella lawrencei* (EVANS, 1957) sind Erstnachweise für diese Provinz, *Lasioseuse floridensis* BERLESE, 1916 ist neu für den Iran. Ein Bestimmungsschlüssel für die 16 besprochenen Arten sowie eine checklist für alle 40 im Iran nachgewiesenen Arten werden geliefert.

### **Introduction**

The superfamily Phytoseioidea comprises the four families Blattisociidae, Otopheidomenidae, Phytoseiidae and Podocinidae, all of which having a phytoseioid sperm access system (ATHIAS-HENRIOT 1968, 1971; ALBERTI & Di PALMA 2002; LINDQUIST et al. 2009). The family Blattisociidae is a diverse group that has adapted to a broad spectrum of terrestrial, arboreal, and subaquatic habits (LINDQUIST et al., 2009). Blattisociidae generally comprises predators and fungivores that are sometimes phoretic on insects. Most species of this family have been reported from litter, while some species have been found on rodent and in bird nests as well as from aerial plant parts. Some species of the genus

*Lasioseius* have been reported feeding on phytophagous mites, small insects, springtails and nematodes while some others have also been observed to feed on fungi. Genus *Blattisocius* includes at least one species with facultative parasitism and another with obligate parasitism of their lepidopteran hosts (TREAT 1975; WALTER and LINDQUIST 1989; CHRISTIAN and KARG 2006; LINDQUIST et al. 2009; BRITTO et al. 2012). The Blattisociidae currently comprises 367 species in 14 genera that grouped into two subfamilies Blattisociinae and Platyseiiinae (LINDQUIST & MORAZA 2010; Linaquist & MORAZA 2011; De MORAES et al., 2016; ALATAWI et al., 2017).

The blattisociid mite fauna of Iran has been studied only marginally. Up to now, 39 blattisociid species have been reported in Iran (KAMALI et al. 2001; HAJIZADEH et al., 2010; KAZEMI & RAJAEI, 2013; ARJOMANDI et al., 2013; KAZEMI et al., 2016; SHAMSI, et al., 2016). Among them 12 species recorded from Guilan Province (DANESHVAR, 1987; KAMALI et al. 2001; NOEI et al., 2008; HAJIZADEH et al., 2010). The aim of the present study was a faunistic investigation on the family Blattisociidae in Guilan Province. An identification key for sixteen mite species of family Blattisociidae recorded from Guilan Province, and a tabulated checklist for forty blattisociid mites recorded from Iran are also provided.

### Materials and methods

A faunal study on family Blattisociidae was carried out in Guilan Province, Northern Iran during 2015-2017. The specimens were collected by extracting soil, stored products, debris, manure, moss, rotten fruit, rotten wood, fungi, dead insects and plant foliage through a BERLESE/Tullgren funnel. Specimens preserved in 75% ethanol, cleared in Nesbitt's fluids and mounted on microscopic slides using Hoyer's medium. The slides were placed in at 45°C for two weeks. The mites were examined under an Olympus BX51 (Olympus Optical Co., LTD., Tokyo, Japan) microscope and identified using valid keys (KARG 1971; GHILYAROV & BREGETOVA 1977; KARG 1993; KALUZ & FENDA 2005; CHRISTIAN & KARG 2006; LINDQUIST & MORAZA 2010; HAJIZADEH et al. 2010; BRITTO et al. 2012; de MORAES et al. 2015; 2016). The voucher material which comprises slide mounted specimens is deposited in the Department of Plant Protection at University of Guilan, Rasht, Iran.

### Results

In the current study 16 species belonging to 5 genera from family Blattisociidae were collected and identified, in Guilan province, Northern Iran. Three species *Blattisocius dentriticus* (BERLESE, 1918); *Lasioseius scapulatus* KENNETT 1958 and *Orthadenella lawrencei* (EVANS, 1957) are new records for the mites fauna of Guilan Province. *Lasioseius floridensis* BERLESE 1916 is new for Iran mites fauna. An identification key to blattisociid mites in Guilan province and a tabulated checklist (Table 1) for forty blattisociid mites recorded from Iran are also provided.

**Table 1:** Checklist of Iran Blattisociid mite species

No	Species	Reference
1	<i>Blattisocius damghaniae</i> KAZEMI ET AL., 2016	SHAMSI, ET AL., 2016
2	<i>Blattisocius dentriticus</i> (BERLESE, 1918)	KAZEMI & RAJAEI, 2013
3	<i>Blattisocius keegani</i> FOX, 1947	KAZEMI & RAJAEI, 2013
4	<i>Blattisocius mali</i> (OUDEMANS, 1929)	KAZEMI & RAJAEI, 2013
5	<i>Blattisocius tarsalis</i> (BERLESE, 1918)	KAZEMI & RAJAEI, 2013
6	<i>Cheiroseius bryophilus</i> KARG, 1969	KAZEMI & RAJAEI, 2013
7	<i>Cheiroseius cascadenis</i> (DE LEON, 1964)	KAZEMI & RAJAEI, 2013
8	<i>Cheiroseius curtipes</i> (HALBERT, 1923)	KAZEMI & RAJAEI, 2013
9	<i>Cheiroseius longipes</i> (WILLMANN, 1951)	KAZEMI & RAJAEI, 2013
10	<i>Cheiroseius manouchehrii</i> SHAMSI & SABOORI, 2013	SHAMSI & SABOORI, 2013
11	<i>Cheiroseius necorniger</i> (OUDEMANS, 1903)	KAZEMI & RAJAEI, 2013
12	<i>Cheiroseius nepalensis</i> (EVANS & HYATT, 1960)	KAZEMI & RAJAEI, 2013
13	<i>Cheiroseius serratus</i> (HALBERT, 1915)	KAZEMI & RAJAEI, 2013
14	<i>Cheiroseius sistaniensis</i> FARAJI ET AL., 2008	KAZEMI & RAJAEI, 2013
15	<i>Cheiroseius unguiculatus</i> (BERLESE, 1877)	ARJOMANDI ET AL., 2013
16	<i>Cheiroseius viduus</i> (KOCH, 1839)	KAZEMI & RAJAEI, 2013
17	<i>Hoploseius bispinosetus</i> FARAJI ET AL., 2006	KAZEMI & RAJAEI, 2013
18	<i>Lasioseius extremus</i> (DANESHVAR, 1987)	KAZEMI & RAJAEI, 2013
19	<i>Lasioseius floridensis</i> BERLESE, 1916	This study
20	<i>Lasioseius frankbakkeri</i> FARAJI & KARG, 2005	KAZEMI & RAJAEI, 2013
21	<i>Lasioseius inconspicuus</i> WESTERBOER, 1963	KAZEMI & RAJAEI, 2013
22	<i>Lasioseius kranzi</i> CHANT, 1963	KAZEMI & RAJAEI, 2013
23	<i>Lasioseius lacunosus</i> WESTERBOER, 1963	KAZEMI & RAJAEI, 2013
24	<i>Lasioseius lawrencei</i> EVANS, 1957	KAZEMI & RAJAEI, 2013
25	<i>Lasioseius mcgregori</i> CHANT, 1963	KAZEMI & RAJAEI, 2013
26	<i>Lasioseius muricatus</i> (KOCH, 1839)	KAZEMI & RAJAEI, 2013
27	<i>Lasioseius ometes</i> (OUDEMANS, 1903)	KAZEMI & RAJAEI, 2013
28	<i>Lasioseius ometisimilis</i> (HIRSCHMANN, 1963)	KAZEMI & RAJAEI, 2013
29	<i>Lasioseius paucisetosus</i> WESTERBOER, 1963	KAZEMI & RAJAEI, 2013
30	<i>Lasioseius penicilliger</i> (BERLESE, 1916)	KAZEMI & RAJAEI, 2013
31	<i>Lasioseius phytoseioides</i> CHANT, 1963	KAZEMI & RAJAEI, 2013
32	<i>Lasioseius qianensis</i> GU & WANG, 1990	KAZEMI & RAJAEI, 2013
33	<i>Lasioseius scapulatus</i> KENNETT, 1958)	KAZEMI & RAJAEI, 2013
34	<i>Lasioseius sugawarai</i> EHARA, 1964	KAZEMI & RAJAEI, 2013
35	<i>Lasioseius thermophiles</i> WILLMANN, 1942	KAZEMI & RAJAEI, 2013
36	<i>Lasioseius youcefi</i> ATHIAS-HENRIOT, 1959	KAZEMI & RAJAEI, 2013
37	<i>Orthadenella lawrencei</i> (EVANS, 1957)	KAZEMI & RAJAEI, 2013
38	<i>Platyseius italicus</i> (BERLESE, 1916)	KAZEMI & RAJAEI, 2013
39	<i>Platyseius persicus</i> KAZEMI ET AL., 2016	KAZEMI ET AL., 2016
40	<i>Platyseius subglaber</i> (OUDEMANS, 1903)	KAZEMI & RAJAEI, 2013

## Checklist of family Blattisociidae in Guilan Province Iran

Superfamily Phytoseioidea KARG, 1965

Family Blattisociidae GARMAN, 1948

Subfamily Blattisociinae GARMAN, 1948

Genus *Blattisocius* KEEGAN, 1944

### *Blattisocius dentriticus* (BERLESE, 1918)

Material examined: 1 ♂, Sangar, 37° 10' 42" N 49° 41' 38" E, 31m, collected from rice bran, June 2017; 1 ♂, Rasht, 37° 17' 0" N 49° 35' 0" E, -17m, collected from colony of *Ephestia* sp. November 2015. This is the first record of *B. dentriticus* from Guilan province Iran.

### *Blattisocius keegani* FOX 1947

Material examined: 1 ♂, Rasht, Jafarabad village, 37° 17' 0" N 49° 35' 0" E, -17m, collected from rice warehouse, July 2015; 4 ♀♀, Sangar, 37° 10' 42" N 49° 41' 38" E, 31m, collected from rice bran, July 2015; 1 ♂, Shaft, Aqa Sayyed Sharif village, 37° 10' 54.42" N 49° 31' 0.41" E, 47 m, collected from rice bran, August 2015; 4 ♀♀, Rasht, University of Guilan, 37° 17' 0" N 49° 35' 0" E, -17m, collected from warehouse rice, August 2015; 1 ♂, Rasht 37° 17' 0" N 49° 35' 0" E, -17m, collected from horse manure, August 2015; 3 ♀♀, Rasht, University of Guilan, 37° 17' 0" N 49° 35' 0" E, -17m, collected from rice plant remnants, August 2015; 1 ♀, Kuchesfahan, 37° 28' 11" N 49° 77' 32" E, 0m, collected from apple leaves, September 2015; 2 ♂♂, Khomam, 37° 23' 21" N 49° 39' 30" E, -17 m, collected from rice bran, November 2015; 2 ♀♀, Rasht, 37° 17' 0" N 49° 35' 0" E, -17m collected from rice bran, August 2016; 2 ♀♀, Rasht, 37° 17' 0" N 49° 35' 0" E, -17m, collected from rice bran, September 2016; 1 ♀, Ziabar, 37° 25' 36" N 49° 14' 48" E, 18m, collected from Sawdust, March 2017; 4 ♀♀, Rasht, University of Guilan, 37° 17' 0" N 49° 35' 0" E, -17m, collected from colony of *Ephestia* sp. August 2017; 1 ♂, Sangar, 37° 10' 42" N 49° 41' 38" E, 31m, collected from rice bran, August 2017.

### *Blattisocius tarsalis* BERLESE 1918

Material examined: 2 ♀♀, Rasht, University of Guilan, 37° 17' 0" N 49° 35' 0" E, -17m, collected from colony of *Plodia* sp., October 2017; 1 ♀, Saravan, 37° 4' 15" N 49° 39' 55" 70m, collected from soil, March 2015; 7 ♀♀, Rasht, 37° 17' 0" N, 49° 35' 0" E, -7m, collected from stored rice, October 2015; 3 ♀♀, Sowme'eh-Sara, 37° 18' 0" N 49° 18' 0" E, 20m, collected from rice bran, November 2016; 2 ♀♀, Emamzadeh Hashem, 37° 01' 27" N 49° 37' 32" E, 115m, collected from straw, November 2016.

### Genus *Cheiroseius* BERLESE, 1916

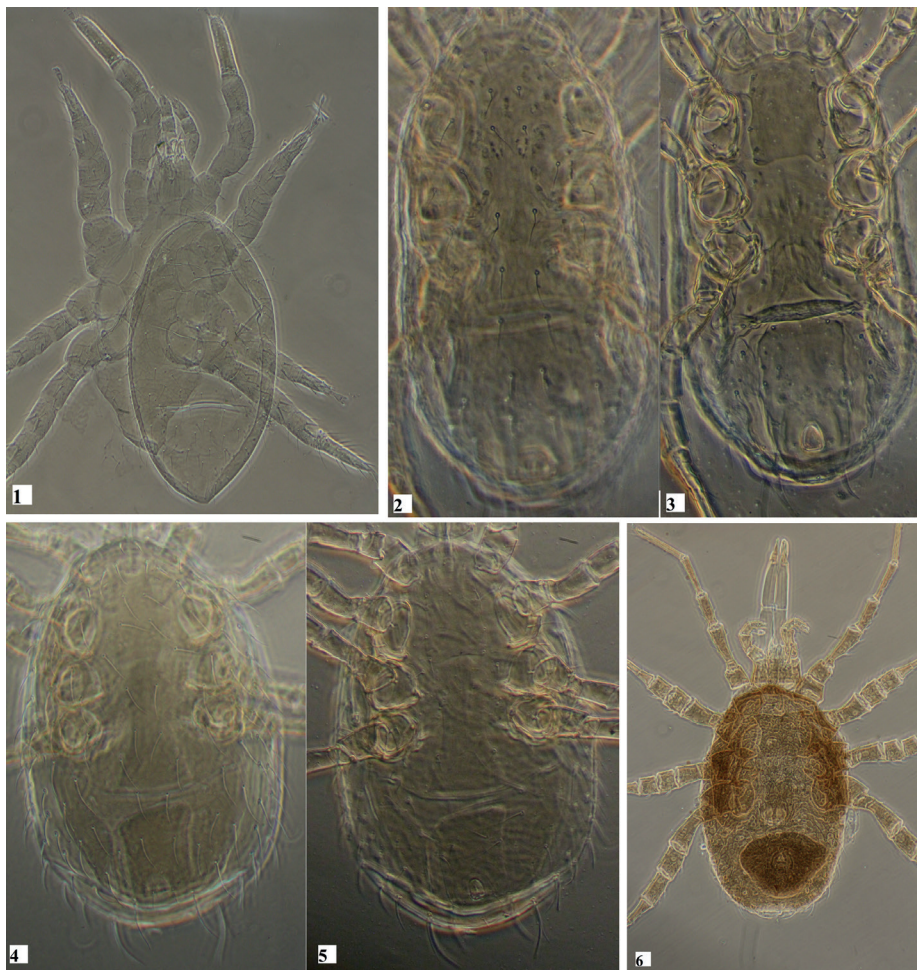
#### *Cheiroseius bryophilus* KARG 1969

Material examined: 1 ♀, Rasht, Saravan forest, 37° 4' 15" N 49° 39' 55" 70m, collected from soil of oak forest, June 2017; 1 ♀, Ziabar, Bahambar village, 37° 25' 36" N 49° 14' 48" E, 18m, collected from soil of rice farm, July 2017; 1 ♀, Rudsar, 37° 8' 0" N 50° 17' 0" E, -19m, collected from soil of hazelnut garden, June 2015; 4 ♀♀, Hashtpar, 37° 48' 6" N 48° 54' 26" E 50m, collected from soil, June 2015; 1 ♀, Rezvanshahr, 37° 33' 4" N 49° 8' 22" E, 15m, collected from soil, June 2015; 3 ♀♀, Rostamabad 36° 53' 54" N 49° 29' 26" E, 400m, collected from soil, June 2015; 1 ♀, Lasht-e-nesha 37° 36' 44" N 49° 85' 78" E, 24m collected from soil, July 2015; 1 female, Astaneh ye Ashrafiyeh, 37° 15' 54" N 49° 56' 40" E, -2m collected from fo-

rest soil, August 2015; 1 ♀, Daylaman, 36° 88' 83" N 49° 90' 64" E, 2200m, collected from forest soil, June 2015; 2 ♀♀, Chubar, 38° 10' 57" N 48° 53' 33" 143m, collected from forest soil, July 2015; 12 ♀♀, Rezvanshahr 37° 33' 4" N 49° 8' 22" E, 15m, collected from soil, July 2015.

***Cheiroseius cascadenis* (DE LEON, 1964)**

**Material examined:** 1 ♀, Langarud 37° 11' 16" N 50° 9' 27" E, -14m, collected from soil of alder and elm forests, May 2015.



**Figs. 1-6.** 1: *Blattisocius dentriticus* (male, ventral view of idiosoma); 2-3: *Blattisocius keegani* (female, dorsal and ventral view of idiosoma respectively); 4-5: *Blattisocius tarsalis* (female, dorsal and ventral view of idiosoma respectively); 6: *Cheiroseius bryophilus* (female, ventral view of idiosoma).

***Cheiroseius curtipes* (HALBERT, 1923)**

Material examined: 1 ♀, Rasht, Saravan forest, 37° 4' 15" N 49° N 49° 39' 55" 70m, collected from soil, July 2015.

***Cheiroseius longipes* (WILLMANN, 1951)**

Material examined: 3 ♀♀, Langarud 37° 11' 16" N 50° 9' 27" E, -14m, collected from soil of alder and elm forests, May 2015; 1 ♀, Rasht, Saravan forest, 37° 4' 15" N 49° N 49° 39' 55" 70m, collected from soil, October 2015.

***Cheiroseius necorniger* (OUDEMANS, 1903)**

Material examined: 1 ♀, Fuman city, Komadul village, 37° 13' 13" N, 49° 18' 34" E, -3m, collected from soil of rice farm, August 2015.

**Genus *Lasioseius* BERLESE, 1916**

***Lasioseius extremus* (DANESHVAR, 1987)**

Material examined: 2 ♀♀, Masuleh, 37° 9' 37" N 48° 59' 32" E, 1050m, collected from rice farm, August 2015; 1 ♀, Daylaman 36° 88' 83" N 49° 90' 64" E, 2200m, collected from soil, June 2015.

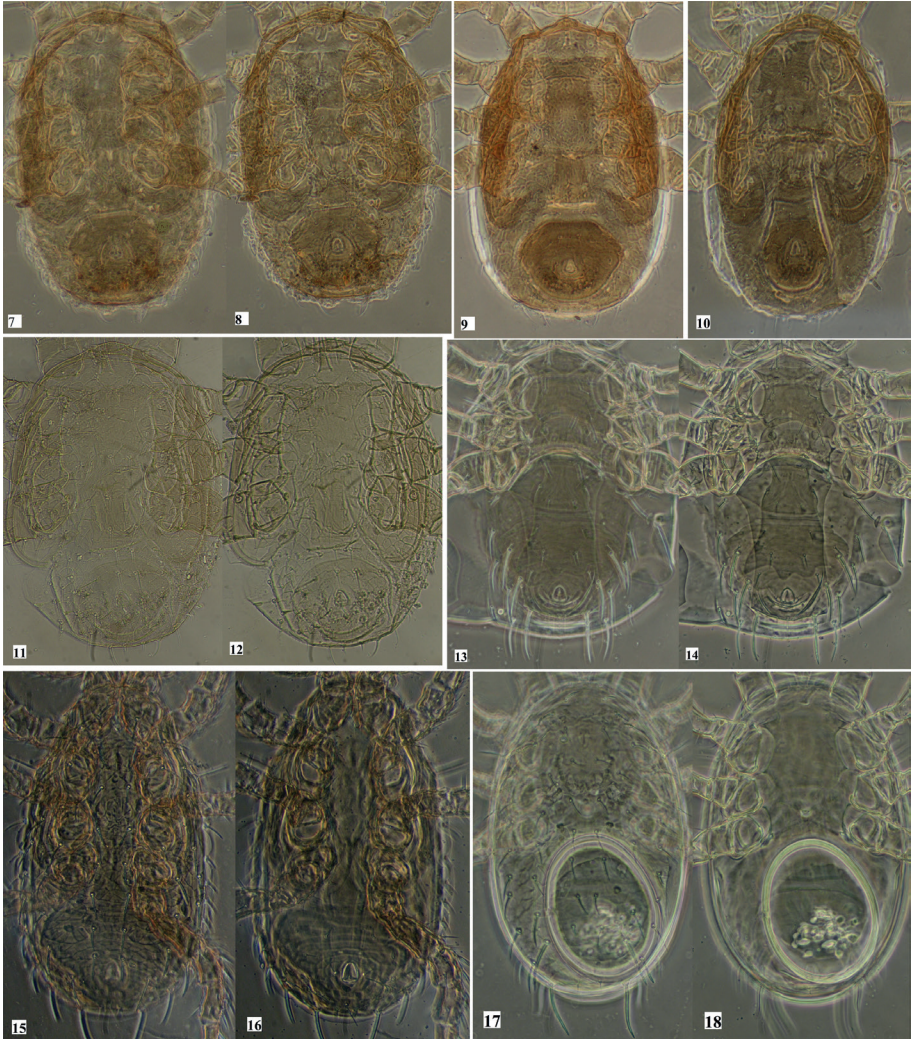
Remark: Daneshvar mentioned that *L. extremus* is very similar to *Lasioseius parberlesi* Bhattacharyya (DANESHVAR, 1987). NEMATI et al. (2012) considered *L. extremus* as synonym of *L. parberlesi*, but DE MORASE et al. (2016) considered the *L. extremus* as a valid species. Probably record of *L. parberlesi* from Iran should be re-considered carefully in future.

***Lasioseius floridensis* BERLESE, 1916**

Material examined: 2 ♀♀, Rasht, University of Guilan, 37° 17' 0" N 49° 35' 0" E, -17m, collected from rotten wood, March 2016; 1 ♀, Rasht 37° 17' 0" N, 49° 35' 0" E, -17m, collected from soil of loquats fruit tree, July 2016; 1 ♀, Ziabar 37° 25' 36" N 49° 14' 48" , 18m, collected from Sawdust, April 2017; 1 ♀, Lahijan, 37° 12' 0" N 50° 0' 0" E, 2m, collected from soil of geranium herb (*Pelargonium* sp.), November 2017. This is the first record from of *L. floridensis* from Guilan Province.

***Lasioseius frankbakkeri* FARAJI & KARG 2005**

Material examined: 1 ♀, Ziabar, Bahambar village 37° 25' 36" N 49° 14' 48" 18m, collected from apple leaves, June 2016; 1 ♀, Rasht, 37° 17' 0" N 49° 35' 0" E, -7m, collected from rotten fruits, August 2015; 4 female, Kuchesfahan 37° 28' 11" N 49° 77' 32" E, 0m, collected from mint leaves and 1 ♀ from apple leaves, December 2015; 6 ♀♀, Khomam, 37° 24' 8" N 49° 35' 37" E, -22m collected from mint leaves, May 2017; 1 ♂, Rasht 37° 17' 0" N, 49° 35' 0" E, -7m, collected from mushroom soil, May 2017.



**Figs. 7-18.** 7-8: *Cheiroseius cascadenis* (female, dorsal and ventral view of idiosoma respectively); 9: *Cheiroseius curtipes* (female, ventral view of idiosoma); 10: *Cheiroseius longipes* (female, ventral view of idiosoma); 11-12: *Cheiroseius necorniger* (female, dorsal and ventral view of idiosoma respectively); 13-14: *Lasioseius extremus* (female, dorsal and ventral view of idiosoma respectively); 15-16: *Lasioseius floridensis* (female, dorsal and ventral view of idiosoma respectively); 17-18: *Lasioseius frankbakkeri* (female, dorsal and ventral view of idiosoma respectively).

***Lasioseius scapulatus* KENNETT 1958**

Material examined: 2 ♀♀, Lowshan, 36° 37' 46" N 49° 30' 50" E, 360m, collected from soil of olive garden, July 2015. This is the first record of *L. scapulatus* from Guilan Province.

***Lasioseius sugawarai* EHARA, 1964**

Material examined: 1 ♀, Lahijan, 37° 12' 0" N 50° 0' 0" E, 2m, collected from tea and mulberry leaves, July 2015; 2 ♀♀, Emamzadeh Hashem, 37° 01' 27" 49° 37' 32" 115m, collected from Alder soil, August 2015; 1 ♀, Langarud, 37° 11' 16" N 50° 9' 27" E, -14m, collected from soil, June 2015; 5 ♀♀, collected from soil of loquats fruit garden, August 2015; 1 ♀, As-taneh ye Ashrafiyeh, 37° 15' 54" N 49° 56' 40" E, -2m, collected from citrus leaves, July 2015; 1 ♀, Rezvanshahr, 37° 33' 4" N 49° 8' 22" E, 15m, collected from soil, October 2015; 1 ♀, Rasht 37° 17' 0" N, 49° 35' 0" E, -7m, collected from rotten fruits, August 2015; 5 ♀♀, Chaboksar 36° 58' 34" N 50° 33' 37" E, 216m, collected from soil of citrus garden, October 2015.

***Lasioseius youcefi* ATHIAS-HENRIOT 1959**

Material examined: 1 ♀, Chaboksar 36° 58' 34" N 50° 33' 37" E, 216m, collected from soil, August 2015; 1 ♀, Rudsar, 37° 8' 0" N 50° 17' 0" E, -19m, collected from soil, October 2015; 3 female, Chaboksar 36° 58' 34" N 50° 33' 37" E, 216m, collected from soil of citrus and pomegranate garden, October 2015.

**Subfamily Platyseiiinae EVANS**

**Genus *Orthadenella* ATHIAS-HENRIOT, 1973**

***Orthadenella lawrencei* (EVANS, 1958)**

Material examined: 2 ♀♀, Rudsar, 37° 8' 0" N 50° 17' 0" E, -19m, collected from soil, October 2015; 1 ♀, Rasht 37° 17' 0" N, 49° 35' 0" E, -17m, collected from soil, June 2015. This is the first record of *O. lawrencei* from Guilan province.

**Genus: *Platyseius* BERLESE, 1916**

***Platyseius subglaber* (OUDEMANS, 1902)**

Material examined: 1 ♀ and 1 ♂, Rasht, Saravan forest, 37° 4' 15" N 49° 39' 55" 70m, collected from soil, May 2015.

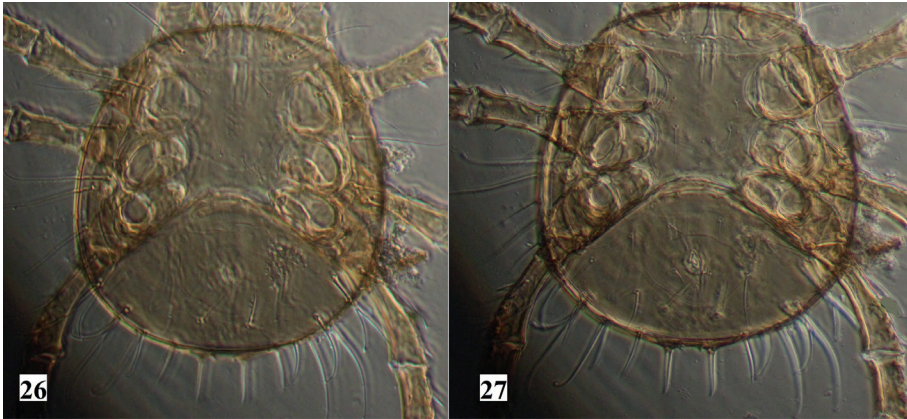




**Figs. 19-25.** 19-20: *Lasioseius scapulatus* (female, dorsal and ventral view of idiosoma respectively); 21-22: *Lasioseius sugawarai* (female, dorsal and ventral view of idiosoma respectively); 23-24: *Lasioseius youcefi* (female, dorsal and ventral view of idiosoma respectively); 25: *Orthadenella lawrencei* (female, ventral view of idiosoma).

**Key to genera and species of Blattisociidae from Guilan Province Iran (♀♀)**

- 1 Legs II-IV with median lobe of pulvillus broadly rounded; para-anal setae inserted anterior to hind margin of anus, and usually shorter than post-anal seta; femora I and II with 12 and 11 setae, respectively; anterior rostral and internal palp trochanter setae gradually tapering along entire length, not whip-like, usually not elongated.....2
- Legs II-IV with median lobe of pulvillus slender; para-anal setae inserted level with or posterior to hind margin of anus, and longer than post-anal seta; femora I and II with 11 and 10 setae, respectively; anterior rostral and internal palp trochanter setae extremely long, whip-like, tapering only near tip ..... 11



**Figs. 26-27:** *Platyseius subglaber* (female, dorsal and ventral view of idiosoma respectively).

- 2    Corniculi narrowly separated, usually slender; tectum convex, smooth; fixed cheliceral digit with few or no teeth; peritrematal shield slender, barely wider than stigma at level of stigma; humeral seta (r3) usually on soft cuticle beside dorsal shield.....*Blattisocius* KEEGAN 3
- Corniculi well separated, stout; tectum convex or triramous, smooth or denticulate; fixed chela usually with many teeth; peritrematal shield clearly wider than diameter of stigma at level of stigma; humeral setae on dorsal shield.....5
- 3    Peritreme normal, extending at least to coxa I; fixed cheliceral digit normal, extends as long as movable digit .....*B. dentriticus* (BERLESE)
- Peritreme reduced, not extending beyond coxa II; fixed cheliceral digit short, at most extends half the length of movable digit .....4
- 4    Movable digit of chelicera with 3 teeth.....*B. tarsalis* (BERLESE)
- Movable digit of chelicera with 1 tooth .....*B. keegani* FOX
- 5    All marginal r-R setae on edge of dorsal shield, opisthotal region of shield with 20 pairs of setae; rows of deutosternal denticles narrow, each with 2–4 denticles; movable cheliceral digit with ridge extending from para-axial surface to 1 or 2 denticles on proximo-ventral surface .....*Orthadenella* ATHIAS-HENRIOT
- With 1–9 pairs of marginal r-R setae on soft cuticle beside dorsal shield, opisthotal region of shield with maximum of 15 pairs of setae; rows of deutosternal denticles moderately wide, each with 5 to many denticles; movable cheliceral digit lacking ridge or denticles on para-axial and ventral surface.....*Lasioseius* BERLESE 6
- 6    Ventrianal shield with 5-6 pairs of preanal setae .....7
- Ventrianal shield with 4 pairs of preanal setae.....8

- 7 Seta Z1 present; J2 1/2 distance J2-J4.....*L. youcefi* ATHIAS-HENRIOT  
 - Seta Z1 absent; J2 1/4 distance J2-J4.....*L. extremus* (DANESHVAR)
- 8 Idiosoma with only 3 pairs of marginal setae (r4, R1, R5) on soft integument.....  
 .....*L. frankbakkeri* FARAJI & KARG  
 - Idiosoma with more than 3 pairs of marginal and submarginal setae on soft integument ....9
- 9 Macrosetae of tarsus IV with 88-92 µm length.....*L. scapulatus* KENNETT  
 - Macrosetae of tarsus IV less than 50 µm length .....10
- 10 Setae Z3 nearly reaching setae S5, tectum with 3 prongs, median point longer than lateral branches; spermatheca conspicuous, with a strongly sclerotized, shallowly cup-shaped calyx and long, relatively thick minor duct; length of idiosoma 390-430 µm .....*L. floridensis* BERLESE  
 - Length of setae Z3 equal two-thirds of distance between Z3 and S5; tectum with 3 prongs, median one as long as laterals; spermathecal apparatus small, weakly sclerotized, bulbous, without discernible minor duct; length of idiosoma 430 µm.....  
 .....*L. sugawarai* EHARA
- 11 Opistonotal region of dorsal shield with 5 pairs of setae in J series; first and third of sternal setae subequal in length; tibia IV with 10 setae .....*Cheiroseius* BERLESE 12  
 - Opistonotal region of dorsal shield with 2-4 pairs of setae in J series; first pair of sternal setae distinctly shorter than third pair; tibia IV with 9 setae .....*Platyseius* BERLESE  
 .....*P. subglaber* (OUDEMANS)
- 12 Peritreme less extended caudally, not overstepping coxa IV; seta j1 strong and direct .....*C. bryophilus* KARG  
 - Peritreme extended from stigma caudally behind coxa IV and curved; dorsal seta j1 small, needle shaped and laterally directed.....13
- 13 Tarsus I shorter than tibia I or equal in length .....*C. longipes* (WILLMANN)  
 - Tarsus I longer than tibia I .....14
- 14 Leg I distinctly longer than the length of idiosoma .....*C. necorniger* (OUDEMANS)  
 - Leg I shorter than the length of idiosoma or about the same length.....15
- 15 Leg I about the same length as idiosoma; antero-medial part of sternal shield with two oval marks forming a M-shaped pattern .....*C. cascadenis* (DELEON)  
 - Leg I distinctly shorter than the length of idiosoma; sternal shield without a M-shaped pattern.....*C. curtipes* (HALBERT)

## Acknowledgements

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